

molded or otherwise manufactured with complex curves. Thus, it would be advantageous to provide a simple and cost effective way to attach tissue pads to clamp arms on curved ultrasonic clamp instruments. It would further be advantageous to provide ultrasonic clamp coagulating instruments with curved end-effectors that were simple to manufacture.

Summary of the Invention

The present invention meets the above stated needs for an improved curved end-effector. A curved clamp arm for use with an ultrasonic surgical instrument is described. The curved clamp arm includes a proximal end and a distal end, with a top surface extending from the proximal end to the distal end of the curved clamp arm. The top surface comprises at least one hole. The clamp arm includes a bottom surface opposite the top surface, with the bottom surface extending from the proximal end to the distal end of the clamp arm. The bottom surface includes at least one engaging surface, where the hole in the top surface extends from the top surface to the engaging surface of the clamp arm. One embodiment of the curved clamp arm includes a plurality of the holes in the top surface, and a plurality of the engaging surfaces in the bottom surface, where each hole in the top surface extends through the curved clamp arm, terminating at a corresponding engaging surface on the bottom surface. The plurality of holes may also be staggered laterally from the proximal end of the clamp arm to the distal end of the clamp arm.

Brief Description of the Drawings

The novel features of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to organization and methods of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in conjunction with the accompanying drawings in which:

Figure 1 illustrates an ultrasonic surgical system including an elevational view of an ultrasonic generator, a sectioned plan view of an ultrasonic transducer, and a partially sectioned plan view of a clamp coagulator in accordance with the present invention;

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Figure 2A is an exploded perspective view of a portion of a clamp coagulator in accordance with the present invention;

Figure 2B is an exploded perspective view of a portion of a clamp coagulator in accordance with the present invention;

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Figure 3 is a partially sectioned plan view of a clamp coagulator in accordance with the present invention with the clamp arm assembly shown in an open position;

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Figure 4 is a partially sectioned plan view of a clamp coagulator in accordance with the present invention with the clamp arm assembly shown in a closed position;

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Figure 5 is a side view of a collar cap of the clamp coagulator;

Figure 6 is a front view of a collar cap of the clamp coagulator;

Figure 7 is a side view of a force limiting spring of the clamp coagulator;

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Figure 8 is a front view of a force limiting spring of the clamp coagulator;

Figure 9 is a side view of a washer of the clamp coagulator;

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Figure 10 is a front view of a washer of the clamp coagulator;

Figure 11 is a side view of a tubular collar of the clamp coagulator;

Figure 12 is a rear view of a tubular collar of the clamp coagulator;

Figure 13 is a front view of a tubular collar of the clamp coagulator;

5 Figure 14 is a side view of an inner knob of the clamp coagulator;

Figure 15 is a front view of an inner knob of the clamp coagulator;

10 Figure 16 is a bottom view of an inner knob of the clamp coagulator;

Figure 17 is a rear view of an outer knob of the clamp coagulator;

Figure 18 is a top view of an outer knob of the clamp coagulator;

15 Figure 19 is a top view of a yoke of the clamp coagulator;

Figure 20 is a side view of a yoke of the clamp coagulator;

Figure 21 is a front view of a yoke of the clamp coagulator;

20 Figure 22 is a perspective view of a yoke of the clamp coagulator;

Figure 23 is a perspective view of an end-effector of the clamp coagulator;

25 Figure 24 is a top perspective view of a clamp arm of the camp coagulator;

Figure 25 is a top view of an end-effector of the clamp coagulator;

30 Figure 26 is a side view of an end-effector of the clamp coagulator with the clamp arm open;

Figure 27 is a top view of a tissue pad of the clamp coagulator;